

IN THE CLAIMS:

1 1. A composition comprising:

2 (a) (i) a quaternary ammonium biocide having the formula



4 (ii) a polymeric quaternary ammonium biocide, or

5 (iii) a mixture thereof; and

6 (b) (i) a ketone acid or salt thereof,

7 (ii) an aromatic carboxylic acid or a salt thereof, or

8 (iii) a mixture thereof,

9 wherein R¹ and R² are independently unsubstituted or hydroxy substituted linear or
10 branched C₁-C₄ alkyl, -(CH₂CH₂O)_mCH₂CH₂OH, or -(CH₂CHCH₃O)_mCH₂CHCH₃OH
11 where m is 1 to 10; R³ is a substituted or unsubstituted benzyl, ethylbenzyl,
12 methylnaphthyl, or linear or branched C₁-C₂₂ alkyl; R⁴ is -R⁵(O)_n(C₆H₅)R⁶ where n is 0 or
13 1; R⁵ is a substituted or unsubstituted C₁-C₈ alkyl or C₁-C₈ alkoxyalkyl; R⁶ is hydrogen or
14 a substituted or unsubstituted, linear or branched C₁-C₁₂ alkyl; and X⁻ is an anion.

1 2. The composition of claim 1, wherein R⁵ is -CH₂CH₂OCH₂CH₂-.

1 3. The composition of claim 2, wherein R⁴ is [2-[2-(4-diisobutyl-
2 phenoxy)ethoxy]ethyl].

1 4. The composition of claim 1, wherein the quaternary ammonium biocide is a
2 salt of benzethonium.

1 5. The composition of claim 4, wherein the quaternary ammonium biocide is
2 benzethonium chloride.

1 6. The composition of claim 1, wherein R⁴ is benzyl.
2 and

1 7. The composition of claim 1, wherein the quaternary ammonium biocide is a
2 salt of benzalkonium.

1 8. The composition of claim 7, wherein the quaternary ammonium biocide is
2 benzalkonium chloride.

1 9. The composition of claim 7, wherein the quaternary ammonium biocide is a
2 salt of (C₁₂-C₁₈) alkyl benzyl dimethyl ammonium.

1 10. The composition of claim 9, wherein the quaternary ammonium biocide is
2 (C₁₂-C₁₈) alkyl benzyl dimethyl ammonium chloride.

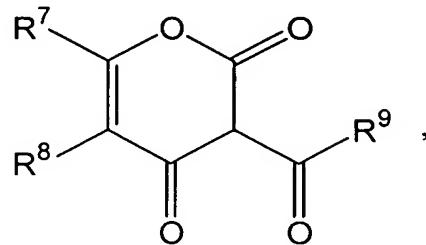
1 11. The composition of claim 1, wherein X⁻ is chloride or carbonate.

1 12. The composition of claim 11, wherein X⁻ is chloride.

1 13. The composition of claim 11, wherein X⁻ is carbonate.

1 14. The composition of claim 1, wherein the ketone acid is a cyclic ketone acid
2 or a salt thereof.

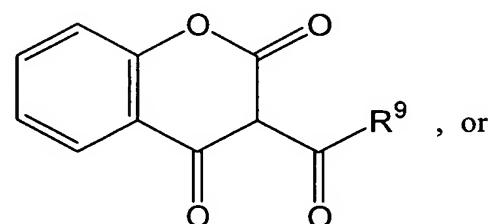
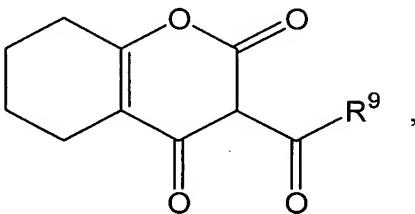
1 15. The composition of claim 14, wherein the cyclic ketone acid has the
2 formula



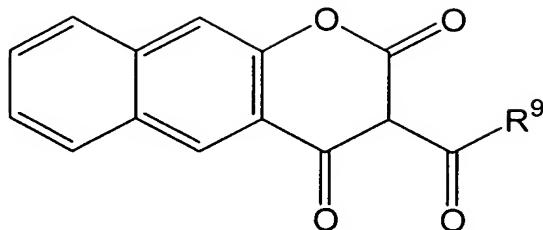
wherein R⁷, R⁸, and R⁹ are independently C₁-C₁₀ alkyl, C₁-C₁₀ alkenyl, C₁-C₁₀ alkenyl, aryl, aryl substituted with halogen, or (C₁-C₁₀ alkyl)aryl.

16. The composition of claim 15, wherein R⁷, R⁸, and R⁹ are independently C₁-C₄ alkyl; or R⁷ and R⁸ form a 5-12 member ring.

17. The composition of claim 15, wherein the cyclic ketone acid has the formula



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1 18. The composition of claim 14, wherein the ketone acid is dehydroacetic acid
2 or a salt thereof.

1 19. The composition of claim 1, wherein the ketone acid is sodium
2 dehydroacetate.

1 20. The composition of claim 1, wherein the ketone acid is encapsulated.

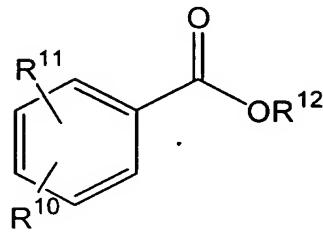
1 21. The composition of claim 18, wherein the dehydroacetic acid or salt thereof
2 is encapsulated in cyclodextrin.

1 22. The composition of claim 1, wherein the quaternary ammonium biocide is
2 benzethonium chloride and the ketone acid is dehydroacetic acid or a salt thereof.

1 23. The composition of claim 1, wherein the quaternary ammonium biocide is
2 benzalkonium chloride and the ketone acid is dehydroacetic acid or a salt thereof.

1 24. The composition of claim 1, wherein the aromatic carboxylic acid is
2 benzoic acid, derivative thereof, or salt thereof.

1 25. The composition of claim 1, wherein the aromatic carboxylic acid has the
2 formula



1 32. The composition of claim 31, wherein the solvent is water, an alcohol, a
2 glycol, an ester, an ether, a polyether or any combination of any of the foregoing.

1 33. The composition of claim 1, wherein the composition comprises a
2 biocidally effective amount of the quaternary ammonium biocide.

1 34. The composition of claim 1, wherein the composition comprises a
2 fungicidally effective amount of the quaternary ammonium biocide.

1 35. The composition of claim 1, wherein the weight ratio of the ketone acid to
2 the quaternary ammonium biocide ranges from about 0.00056:1 to about 1990:1.

1 36. The composition of claim 35, wherein the weight ratio of the ketone acid to
2 the quaternary ammonium biocide ranges from about 0.0056:1 to about 1400:1.

1 37. The composition of claim 1, wherein said composition comprises from
2 about 0.00005 to about 0.5% by weight of ketone acid and from about 0.00005 to about
3 0.45% by weight of quaternary ammonium biocide, based upon 100% weight of total
4 composition.

1 38. The composition of claim 37, wherein said composition comprises from
2 about 0.0005 to about 0.35% by weight of ketone acid and from about 0.0005 to about
3 0.2% by weight of quaternary ammonium biocide, based upon 100% weight of total
4 composition.

1 39. The composition of claim 1, wherein the weight ratio of the aromatic
2 carboxylic acid to the quaternary ammonium biocide ranges from about 0.00056:1 to about
3 1990:1.

1 40. The composition of claim 39, wherein the weight ratio of the aromatic
2 carboxylic acid to the quaternary ammonium biocide ranges from about 0.0056:1 to about
3 1400:1.

1 41. The composition of claim 1, wherein said composition comprises from
2 about 0.00005 to about 0.5% by weight of aromatic carboxylic acid and from about
3 0.00005 to about 0.45% by weight of quaternary ammonium biocide, based upon 100%
4 weight of total composition.

1 42. The composition of claim 41, wherein said composition comprises from
2 about 0.0005 to about 0.35% by weight of aromatic carboxylic acid and from about 0.0005
3 to about 0.2% by weight of quaternary ammonium biocide, based upon 100% weight of
4 total composition.

1 43. An antimicrobial composition comprising a synergistic mixture of:
2 (a) dehydroacetic acid or a salt thereof; and
3 (b) benzethonium chloride.

1 44. An antimicrobial composition comprising a synergistic mixture of:
2 (a) salicylic acid or a salt thereof; and
3 (b) benzethonium chloride.

1 45. A method of inhibiting the growth of microorganisms comprising applying
2 an effective amount of the composition of claim 1.

1 46. A preservative formulation comprising a synergistic mixture of:

2 (a) dehydroacetic acid or a salt thereof;
3 (b) a benzethonium salt; and
4 (c) salicylic acid or a salt thereof.

1 47. The preservative formulation of claim 46, further comprising:

2 (d) benzoic acid or a salt thereof;
3 (e) phenoxyethanol; and
4 (f) benzyl alcohol.

1 48. The preservative formulation of claim 47 comprising:

2 (a) from about 5 to about 40% by weight of dehydroacetic acid;
3 (b) from about 1 to about 20% by weight of benzethonium chloride;
4 (c) from about 2.5 to about 20% by weight of salicylic acid;
5 (d) from about 2.5 to about 20% by weight of benzoic acid;
6 (e) from about 20 to about 50% by weight of phenoxyethanol; and
7 (f) from about 5 to about 50% by weight of benzyl alcohol,

8 based upon 100% total weight of preservative formulation.

1 49. The preservative formulation of claim 48 comprising:

2 (a) about 10% by weight of dehydroacetic acid;
3 (b) about 5% by weight of benzethonium chloride;
4 (c) about 10% by weight of salicylic acid;

5 (d) about 10% by weight of benzoic acid;
6 (e) about 35% by weight of phenoxyethanol; and
7 (f) about 30% by weight of benzyl alcohol,

8 based upon 100% total weight of preservative formulation.

1 50. A composition comprising from about 0.01 to about 2% by weight of the
2 preservative composition of claim 48.

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